OMI

NEW HAVEN EAST SHORE
WATER POLLUTION ABATEMENT FACILITY

STANDARD OPERATING PROCEDURES

Revision #1

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EAST SHORE MAIN SEWAGE PUMPS

SUBJECT: OPERATION AND MAINTENANCE OF THE EAST SHORE MAIN SEWAGE PUMPS

PURPOSE:

A. After studying and practicing this SOP the Operations Personnel should be able to:

B. Explain in their own words the need and importance of the Main Sewage pumps in our Wastewater Treatment Facility.

C. Explain why, how, and when the Main Sewage pumps should be rotated.

D. Use the SCADA to rotate and/or switch its speed.

E. Monitor at least twice per shift the operation of the Main Sewage pumps and immediately report any unusual problems to the Lead Operator or the Operations Manager.

F. Explain in their own words what procedures should be followed in case there is a power failure and the main sewage pumps do not run.

G. Explain why only the certified electrician is authorized to perform any electrical repairs.

SCOPE/LOCATION:

This Main Sewage Pump SOP is addressed to all Operations Personnel, Maintenance personnel and electricians.

- The Main sewage pump motors are located in the second floor of the East Shore Water Pollution Abatement Facility administrative building.

SAFETY:

Follow the noise safety rules posted in the area. Request and use earplugs if recommended.

- Tripping or slipping around the pumps area.
- Avoid electrocution: Do not touch any electrical wires near or attached to the pumps.

PROCEDURE:

There are five Main Sewage pumps. Pumps number 1, 3 and 5 are rated at 15 MGD. Pumps 2 and 4 are rated at 25 MGD.

These pumps are controlled by Adjustable Frequency Drives (AFD), located in the Pumps Motor Control Room, which is on the second floor of the administrative building.

These pumps could be automatically or manually controlled from the SCADA system. At the end of this SOP, manual operation from the AFD's is explained. In the automatic mode, the pumps adjust speed to maintain a wet well level set point.

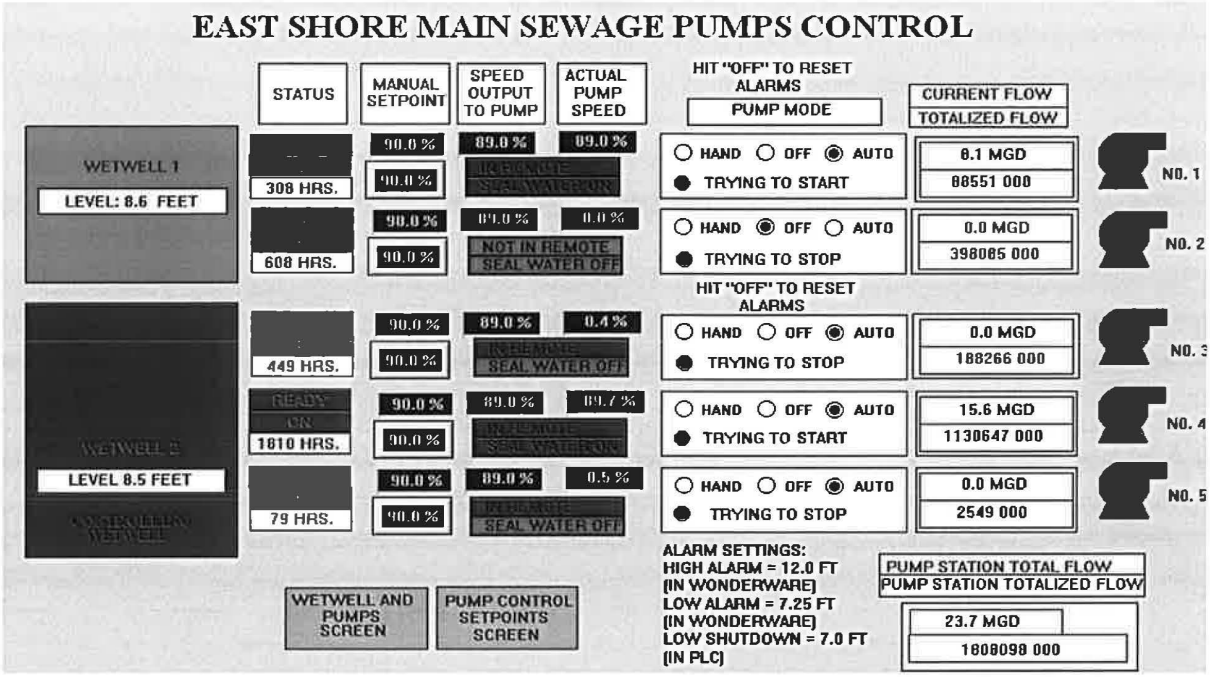


Figure 1

EAST SHORE MAIN SEWAGE PUMPS CONTROL SCREEN

Reading the computer screen from the left side to the right side(fig:1):

1. **WETWELLS**: Two wet wells are displayed. The controlling wet well will be displayed in red. Changing which wet well is controlling will be covered later in this SOP.
2. **STATUS:**
   - **A. READY:** Indicates that the pump is ready to be operated from SCADA.

     The following conditions must be met for the READY status:

     1. DO NOT SHOW A SEAL FAIL ALARM.
     2. DO NOT SHOW A FAIL TO START ALARM.
     3. DO NOT SHOW AN AFD FAIL ALARM.
     4. THE HAND-OFF-REMOTE SWITCH AT THE DRIVE PANEL IS IN REMOTE.
     5. NON OF THE PUMPS EMERGENCY STOPS ARE ENGAGED.

B. **NOT READY:** Indicates that the pump is not ready to be operated from SCADA.

C. **ON:** Indicates that the pump is running.

D. **OFF:** Indicates that the pump is off.

E. **HOURS:** Indicates the pump run time in hours.

F. **IN REMOTE/ NOT IN REMOTE:** Indicates the status of the selector switch at the Adjustable Speed Drive Panel.

G. **SEAL WATER ON/SEAL WATER OFF:** Indicates that there is seal water pressure at the pump, it does not mean that you have flow.

To verify if there is flow: GO TO THE PUMP AND LOOK AT THE WATER ROTOMETER.

3. **MANUAL SET-POINT:** Enter the desired pump speed in percent in the lower box. The upper box is a confirmation that the system has received your set point.

4. **SPEED OUTPUT TO PUMP:** This box is an indication of the desired speed that the Scada system has chosen for the pump to run, it is not the actual speed of the pump.

5. **ACTUAL PUMP SPEED:** It will display the actual speed. The actual speed should be close to the speed output to pump as described above.

6. **PUMP MODE:**

A. **HAND:** Pressing the "HAND" button will START the pump if the system is ready. Upon starting pump, pump will ramp up to manual set point.

B. **OFF**: Pressing the "STOP" button will stop the pump.

C. **AUTO:** Pressing the "AUTO" button will put the pump in automatic control.

D. **TRYING TO START:** If it is GREEN, SCADA will have the pumps OFF.

If it is RED, SCADA tries to start the pump.

If the pump DOES NOT START, the pump symbol will turn YELLOW, and the pump will show fail.

7. **CURRENT FLOW / TOTALIZED FLOW**

   A. **CURRENT FLOW:** This is the FLOW of the pump.

      Whenever the pump is OFF the value will be zero.

   B. **TOTALIZED FLOW:** This is the total flow of the pump and it shows the actual value in thousands of gallons.

8. **PUMP SYMBOLS:**

   A. **RED:** Indicates that the pump is ON.

   B. **GREEN:** Indicates that the pump is OFF.

   C. **YELLOW:** Indicates that there is a problem. (Failure)

   Pushing the OFF bottom will RESET and CLEAR the alarm in SCADA, but not the alarm at the AFD's, which have to be reset at unit.

   To find the specific alarm: Check the AFD keypad in the Pump AFD room.

MAIN SEWAGE PUMPS AND WETWELL SCREEN

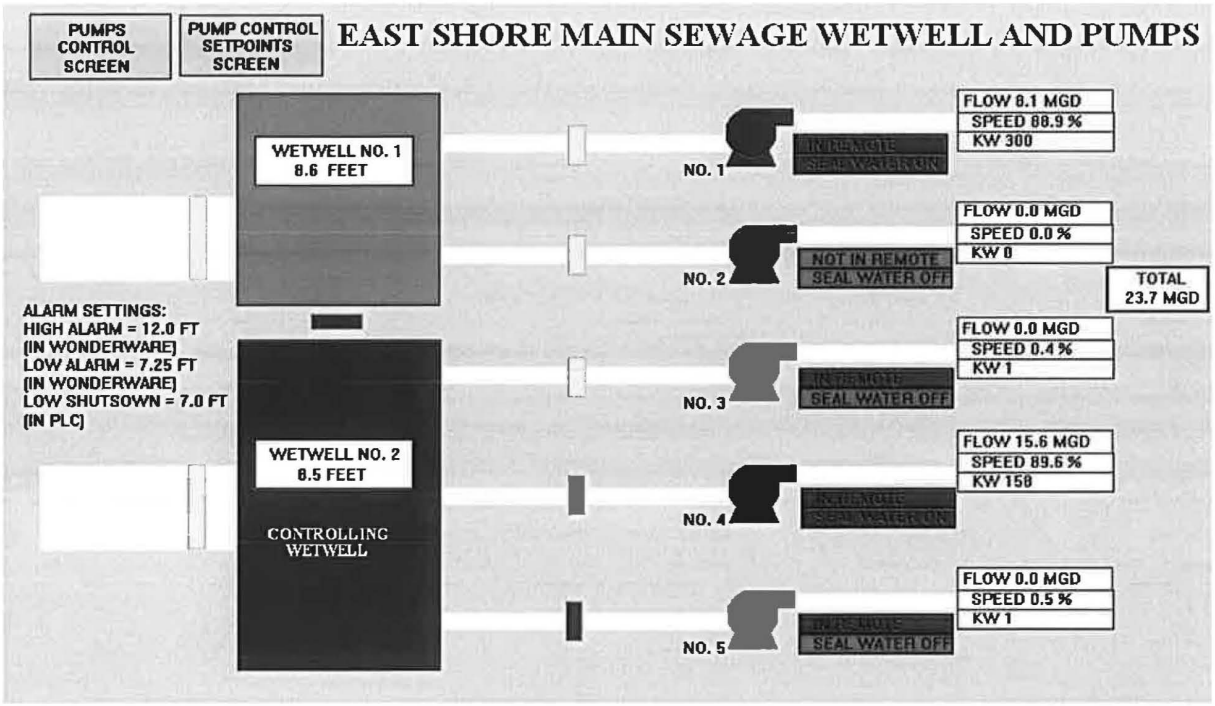


Figure 2

EAST SHORE MAIN SEWAGE PUMPS AND WETWELL SCREEN

THIS SCREEN INDICATES THE STATUS OF THE MAIN SEWAGE PUMPS, WET WELL LEVEL/CONTROLL, PUMP SPEEDS, PUMP FLOWS, KILOWATTS, AND TOTAL FLOW.

MAIN SEWAGE PUMPS CONTROL SETPOINT SCREEN

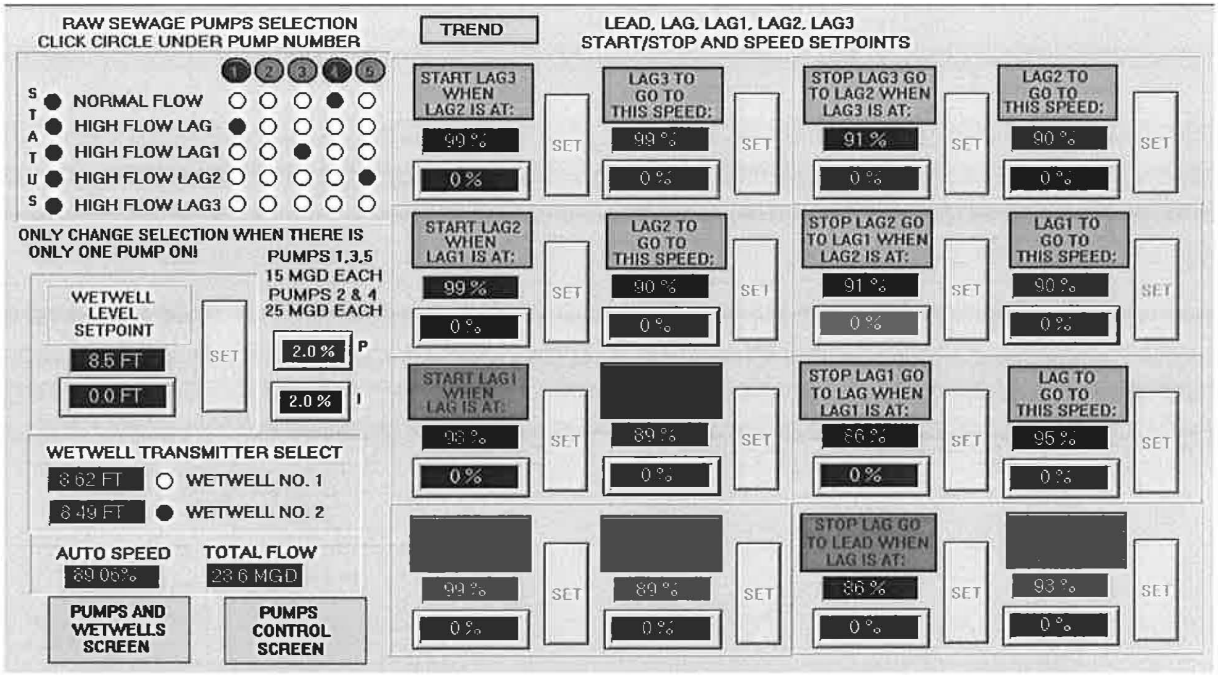


Figure 3

EAST SHORE MAIN SEWAGE PUMPS SETPOINT SCREEN

THIS SCREEN IS THE MAIN SETUP SCREEN USED TO INPUT PERAMETERS FOR CONTROL OF THE MAIN SEWAGE PUMPS BY SCADA SYSTEM.

READING THE SCREEN FROM THE LEFT SIDE TO THE RIGHT SIDE (fig 3):

A. UPPER LEFT: This is the pump SELECTION area.

There are five (5) pumping conditions:

1. **NORMAL FLOW:** This is the Lead Pump.
2. **HIGH FLOW LAG:** This occurs when the flows are above 12 MGD, but below 25 MGD. When this occurs and a 15 MGD pump is ON and a 25 MGD pump has been selected, the 15 MGD pump will stop and the 25 MGD pump will start.
3. **HIGH FLOW LAG 1:** This occurs when the flows are above 25 MGD and below 40 MGD. When the latter occurs, the selected LAG 1 pump will START.
4. **HIGH FLOW LAG 2:** This happens when the flows are above 40 MGD and below 50. When this occurs the selected LAG 2 pump will start.

5. **HIGH FLOW LAG 3:** This happens when the flows are above 50 MGD. When this occurs the selected LAG 3 pump will start. Based on the present installation, the only reason that this will occur is if there is a problem with the other pumps. Only one pump can be selected for each pumping condition. If that pump has been selected for another condition, is will be removed from that condition and placed into the new selected condition. Above the selection, there are five circles with pump numbers in them.

   If the circle is GREEN, the pump is OFF.

   If the circle is RED the pump is on.

   On the left side of the pumping conditions, there are five (5) circles:

   If the circle is GREEN, the pump is not pumping.

   If the circle is RED, that pump is pumping.

6. **MIDDLE LEFT SIDE OF SCREEN**: Enter the Wet well level set point here. Normally the set point should be between eight and twelve feet. To the right of the set point are tuning parameters to be used to tune the loop, (not accessible).

7. **BOTTOM LEFT SIDE OF SCREEN**: The wet well transmitter select. There are two level transmitters, one in each wet well. If both wet wells are "online" and both transmitters are reading close to each other, it does not matter which transmitter is selected. If a wet well is taken out of service or a level transmitter giving a wrong signal, then select the other transmitter. Automatic speed indicates the requested speed of the main sewage pump based on the automatic level control program. Total flow: Refers to the total flow of the Main sewage pumps.

8. **MIDDLE AND RIGHT SIDE OF SCREEN**: This is where the pumping conditions set points are entered. For each condition, there are two set points:

   - One is the set point for when the conditions is to happen.
   - The other set point is for which speed the pumps are to go when the condition does happened. For example, under the "start lag," when the LEAD is at box, enter the speed set point that will cause the LAG pump to start and the LEAD pump to STOP.

     Typically all of the "START" set points should be 99 to 100, because you want in this case that the lead pump (15 MGD) maxed out before you want to START the (25 MGD LAG) pump. Because the 25 MGD pump does pump more than the 15 MGD, you need to enter the speed that you want the 25 MGD pump to START at. In this case it is usually **around 91% which would almost produce the same flow as a small pump going**

at 100%. Any change to the set points shall be entered in the Operator's Log Sheet. Some notes about this part of the control:

A. Once the speed hits the speed START or STOP set points, the program will wait three minutes to allow the level to stabilize and then will START or STOP at the new pumping condition.

B. The boxes associated with the condition are green, when that condition is not happening. The box is RED when that condition is happening.

The upper most RED BOX is the condition that is being monitored.

C. When a stop pump conditions is met, that pump should STOP. The pump that is to STOP will wait 90 seconds to allow a starting pump to start up.

An example of this is when the STAT HIGH FLOW LAG Pump condition is met. A 25 MGD pump will start, (it takes about 90 to 100 seconds for the pump to ramp up). 90 seconds after the 25 MGD pump starts, the 15 MGD lead pump will stop.

AUTOMATIC OPERATION:

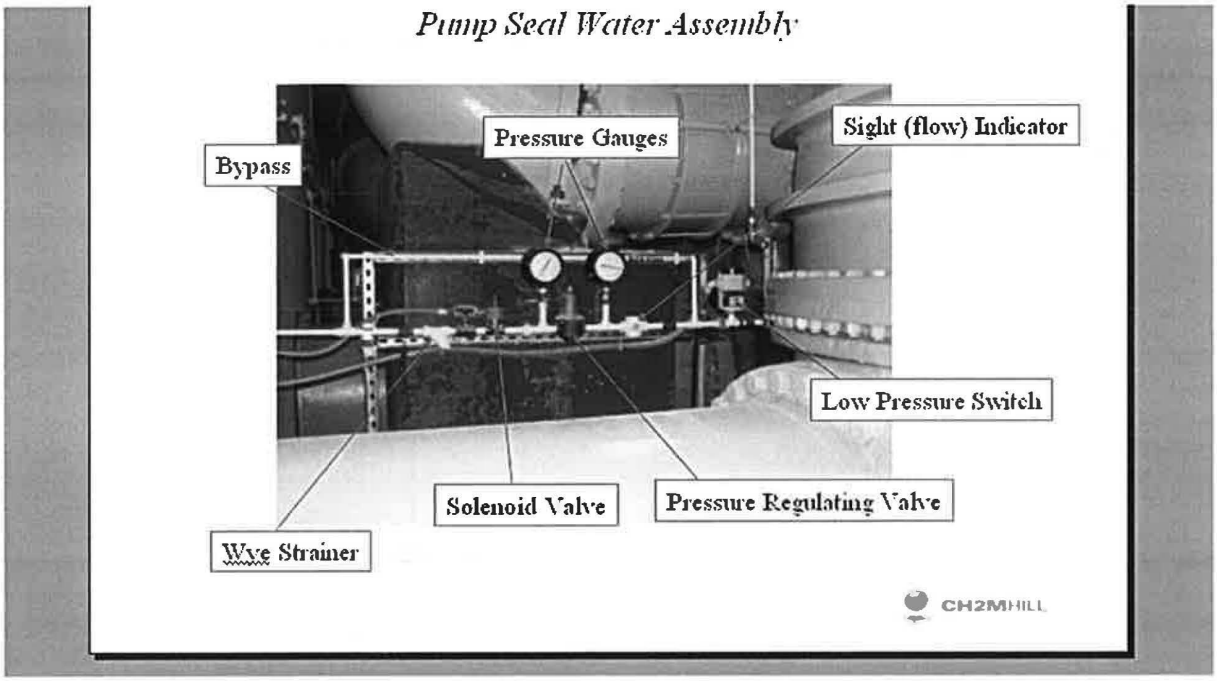
1. Go to the pump control screen and put the pump into "OFF". This will ensure that the pump will not accidentally start until you want it to.
2. Go to the pump room and verify that the seal water manual valves for the pump are open. If the bypass valve is open, you can close it unless there is a problem.
3. Go to the adjustable speed drive and do the following:
   A. Turn the power breaker ON.
   B. Put the HAND-OFF-REMOTE selector switch into REMOTE.
4. Go to the Main Sewage pumps set point screen and do the following:
   A. Select the LEAD, LAG, LAG1, LAG2, LAG3 pumps.
   B. Select the wet well level transmitter to be used for control.
   C. Enter the wet well level set point, normally 8.6 feet.
5. Go to the pumps control screen and to the following:
   A. For the pumps selected, click on "AUTO": If you are starting up for the first time for some reason, put the selected lead pump into "AUTO", and wail a while to allow the control system to "CATCH UP" and then put the other pumps into "AUTO.

6. When a pump starts, the following should happen:

   A. Trying to start, the circle should turn RED indicating that the PLC is trying to START the pump.

   B. The pump symbol should turn RED indicating that the pump has actually started.

   C. The seal water on status should be visible indicating that the seal water solenoid has opened. If not inspect the seal water system immediately.

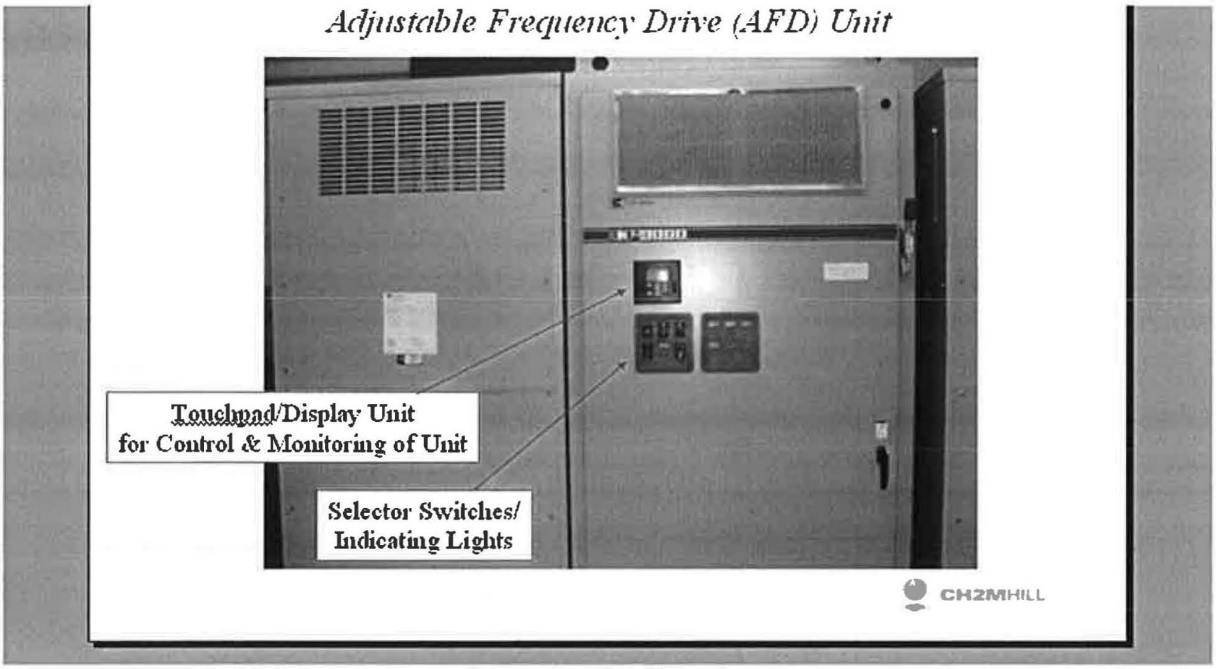


EAST SHORE MAIN SEWAGE PUMPS SEAL WATER SYSTEM

NOTE THE FOLLOWING:

1. THE SEAL WATER BYPASS PIPING (THE UPPER HORIZONTAL PIPING). BECAUSE THE BYPASS DOES NOT GO THROUGH A REGULATOR, YOU NEED TO ADJUST WATER FLOW MANUALLY.
2. THE SIGHT INDICATOR (SEAL WATER FLOW INDICATION). SPECIFIC FLOW SETTINGS TO BE DETERMINED BASED ON WHAT TYPE OF SEAL IS USED WITH THE PUMP. CONSULT MAINTANCE.

Adjustable Frequency Drive (AFD) Unit



EAST SHORE MAIN SEWAGE PUMPS ADJUSTABLE FREQUENCY DRIVE

MANUAL OPERATION FROM SCADA

1. Go to the Pump Control Screen and put the pump into "OFF". This will ensure that the pump will not accidentally start until you want it to.
2. Go to the pump room and verify that the seal water manual valves for the pumps are open. If the bypass valve is open, you can close it, unless you encounter some problem.
3. Go to the Adjustable Speed Drive and do the following:
    A. Turn ON the power breaker.
    B. Put the HANDS-OFF-REMOTE selector switch into REMOTE.
4. Go to the pumps control screen and do the following:
    A. For the pump selected, enter the desired manual speed set point.
    B. For the pump selected, click the ON bottom.
5. When a pump starts, the following should happens:
    A. The trying to start circle should turn RED indicating that the PLC is trying to START the pump.

B. The pump symbol should turn RED indicating that the pump has actually STARTED.

C. The seal water ON status should be visible, indicating that the seal water solenoid has opened. If not, inspect the seal water immediately.

LOCAL CONTROL FROM ADJUSTABLE FREQUENCY DRIVE

(SEE WARNING BELOW)

This instructions are not recommended for qualified the Maintenance personnel only, and not for Operations personnel.

1. **Go to the pump room and verify that the seal water manual valves for the pumps are OPEN. You will have to OPEN the Manual Bypass Valve also, only when running the pump from the Adjustable Frequency Drive).**
2. **Go to the Adjustable Speed Drive and do the following:**
   - **A. Turn ON the power breaker.**
   - **B. Put the HAND-OFF-REMOTE selector switch in HAND.**
   - **C. Adjust the speed of the pump with the speed control knob.**

WARNING! THERE ARE NO LEVEL CUTOFFS WHEN RUNNING MANUALLY FROM THE ADJUSTABLE FREQUENCY DRIVE!